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PLEASE NOTE

This report presents unevaluated information on Soviet-Bloc Activities in the International Geophysical Cooperation program from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

"INTERNATIONAL GEOPHYSICAL COOPERATION" PROGRAM --
SOVIET-BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Kurkarkin on Problems of Space Flights

Members of the diplomatic corps attended a lecture given at the Moscow Planetarium by Prof B. V. Kukarkin, vice-president of the International Astronomical Union. Prof Kukarkin spoke on the problems of cosmic flights, the path to which was blazed by the Soviet artificial earth satellites. ("Problems of Cosmic Flight"; Moscow, Izvestiya, 11 Mar 59, p 6)

Mechta Exhibit at Moscow Planetarium

A new stand was recently added to the astronomical exhibit in the Moscow Planetarium. This features a large drawing depicting the motion of the Earth and Mars around the Sun. Between their orbits runs a bright red line. This is the orbit of the new Soviet artificial planet Mechta [Artificial Planet No 1]. The location of this new celestial body in relation to the Earth, as it changes daily, is shown on the drawing. At present, its distance from the Earth is calculated at 17 million kilometers.

A cosmic particle counter, similar to those carried by Sputniks II and III and Mechta, is demonstrated by lecturers, and visitors can hear the characteristic crackle and see the scintillation of the neon lamp as it registers electrically charged particles reaching the Earth from terrestrial space.

Another recent addition to the exhibit is a large relief map of the Moon. This is of great interest, says V. Lutskiy, a lecturer at the planetarium, because the first interplanetary flight will be made to this body. In the very center of the lunar disc, the crater of Alphonsus, in which the Soviet astronomer Kozyrev observed what is claimed to be a volcanic eruption, can be seen. ("Where Is Our Artificial Planet Now?" by V. Lutskiy, Moscow Planetarium lecturer; Moscow, Izvestiya, 14 Mar 59, p 4)

Molecular Clock in Satellite Suggested for Testing Relativity Theory

The Physics Institute of the Academy of Sciences USSR, has reportedly developed several molecular generators in which molecules of ammonia emit radio waves. Since the molecules in these generators, in contrast to the parts contained in the usual electron generators, neither deteriorate nor age, their vibrations are characterized by their unusual stability. If an electric clock were made to run with current from the new generator, instead of the usual alternating current, it would err by not more than one second in 300 years.

On the basis of molecular generators, accurate time service will be created; with their aid it will be possible to increase the accuracy of radio navigation systems to develop extra-long range radar, to improve the operation of radio broadcasting stations, and to create a new basis for measuring physical and engineering values. When more compact molecular generators are achieved, scientists will place them in artificial earth satellites and test the principle of the general theory relativity.

The builders of these generators, N. G. Basov and A. M. Prokhorov, Doctors of Physicomathematical Sciences, have been nominated for Lenin Prizes "Outshoots of a New Science," by I. Radunskaya, engineer; Moscow, Izvestiya, 18 Mar 59, p 6; "For Investigating the Universe," by V. Kuznetsov, Engr-Lt Col, Docent, Candidate of Technical Sciences; Moscow, Sovetskaya Aviatsiya, 15 Mar 59, p 2)

II. UPPER ATMOSPHERE

Results of Atmosphere Observations in Egypt Interpreted

The following comments are given on the Soviet IGY expedition to southern Egypt:

"The Academy of Sciences USSR sent the expedition to make observations on zodiacal light and optical properties of the atmosphere, chiefly those connected with its upper layers, where the presence of meteoric dust might be expected. The expedition worked for 2 months south of Aswan, in the Libyan Desert below the tropic of Cancer. Several conclusions concerning the properties of the interplanetary medium can be drawn on the basis of its observations.

It was established, for example, that zodiacal light differs from a purely continuous spectrum. The ordinary emission lines of the night sky are not stronger in it, contrary to what had been assumed previously. Its light is practically no different from solar light. The rather considerable polarization of zodiacal light is fully explained by the optical properties of fine cosmic dust which is characteristic of high atmospheric layers. There is consequently no necessity to assume additional scattering of light by free electrons. Rather, all the properties of zodiacal light which were observed are fully explained by the scattering of solar light produced by cosmic dust without any appreciable participation of the gas. The maximum gas density at the distance of the Earth's orbit could not be more than 20-30 atoms and free electrons per cubic centimeter and not 600-800, as has been held up until now.

Isophots of zodiacal light observed below the tropics are no doubt narrower than those visible in Central-Asian deserts, where the ecliptic has a large inclination to the horizontal. This indicates that there is an additional cause of the illumination of the night sky, namely, troposphere scattering of illumination produced by the zodiacal light. Until now, little attention was paid to this illumination.

Even the narrower isophots of zodiacal light, however, which were obtained with consideration of all additional light sources do not permit one to explain its origin in terms of the gradual breaking down of asteroids. The later no doubt occurs, since it follows necessarily from the low "cosmic" ages which have been assigned to many meteorites studied.

To explain these phenomena, it is necessary to hypothesize that the interplanetary medium is constantly being replenished by the disintegration of asteroids and periodic comets. It is also constantly being deposited on the sun and swept out of the solar system by the pressure of solar radiation.

It should be noted that the properties of interplanetary space are entirely different from those of interstellar space. In the neighborhood of our sun there is comparatively little gas and much dust. This interplanetary dust is of secondary origin and indirectly indicates the existence of bodies of an asteroidal and comet nature from which it is produced.

May not the diffuse nebulae with a continuous spectrum around certain stars indirectly indicate the existence of similar bodies in cosmic space? ("News in the Study of the Interstellar and Interplanetary Medium," by Academician V. G. Tesenkov, Astrophysics Institute, Academy of Sciences Kazakh SSR, (Alma Ata); Moscow, Priroda, No 2, Feb 59, pp 4-7)

Work on Variations in the Intensity of Cosmic Rays Published by Yakutsk Affiliate of the Academy of Sciences USSR

The second issue of Trudy Yakutskogo Filiala, Akademii Nauk SSSR, Seriya Fizicheskaya (Works of the Yakutsk Affiliate, Academy of Sciences USSR), 1958, subtitle, Variations in the Intensity of Cosmic Rays, contains articles on an experimental method of continuous registration of cosmic rays, the investigation of the meteorological effects of the different components of cosmic rays, and the relation of variations in the intensity of cosmic rays to the activity of the Sun and geomagnetic activity.

Part I consists of articles describing the apparatus used for measuring the intensities of cosmic rays on the surface of the Earth, underground, and in the upper layers of the atmosphere. The automatic ionization chamber ASK (avtomaticheskaya stantsiya kosmicheskikh luchey), which is the basic instrument in Soviet cosmic ray stations, is described in particular. Some suggestions for further improvements of this instrument are given which are based on a generalization of many years of experience in its operation. The counter telescope installations intended for studying the energy characteristics of cosmic ray variations at different levels underground and the instruments for mass measurements of the intensity of cosmic rays in the stratosphere are also described.

Part II contains articles devoted to the theories, methods, and results of investigations of the meteorological effects of the different components of cosmic rays.

Part III is devoted mainly to the nature of the diurnal variations of cosmic rays. Some results of these works are discursive and need wider consideration in the future.

The works included in issue two of the Trudy Yakutskogo Filiala were discussed at meetings of the Physics Section, Eighth Scientific Session of the Yakutsk Affiliate, Academy of Sciences USSR, held in April 1956. Many of these works were presented in seminars of the Yakutsk Cosmic Ray Laboratory, in NIZMIR (Scientific Research Institute of Terrestrial Magnetism of the Ionosphere and Radio Wave Propagation) and in ANII (Arctic Scientific Research Institute).

In addition to the articles by associates of the Yakutsk Affiliate, articles by scientific associates in NIZMIR, ANII, Sverdlovsk, Irkutsk, and the Cape Shmidt cosmic ray stations (L. I. Dorman, N. S, Kaminer, Ye. S. Glokova, N. A. Mishina, L. A. Fuks, B. F. Shvartsman, G. I. Freydman) are included.

The authors of the publication express their appreciation of the constant aid rendered by S. N. Vernov, Corresponding Member Academy of Sciences USSR; Prof Ye. L. Feynberg; and N. L. Grigorov, Doctor of Physicomathematicaal Sciences.

The contents of the publication follow.

Part I. Apparatus for Measuring Variations in the Intensity of Cosmic Rays

Yu. G. Shafer, "Continuous Registration of Variations in the Intensity of Cosmic Rays With an Automatically Controlled Ionization Chamber.

Yu. G. Shafer, "Further Refinement of the Automatic Cosmic Ray Station."

A. I. Kuz'min, A. V. Yarygin, "Apparatus for Measuring Variations in the Intensity of Cosmic Rays Underground."

V. A. Belomestnykh, Yu. G. Shafer, "Variations in the Intensity of Cosmic Rays in the Stratosphere and the Methods for Registering and Investigating Them."

Part II. Meteorological Effects

L. I. Dorman, "Theory of the Meteorological Effects of Soft and Total Ionizing Components of Cosmic Rays.

L. I. Dorman, "Theory of the Temperature Effect of the Neutron Components of Cosmic Rays."

N. S. Kaminer, "Problem on the Extrapolation of Temperatures in the Lower Stratosphere Region."

V. D. Sokolov, "Method of Introducing Temperature Corrections in the Results of Measurements of the Intensity of Hard Components of Cosmic Rays According to Data of a Temperature Profile of the Atmosphere up to 5-6 Kilometers."

G. V. Tyanutova, "Preliminary Results of a Comparison of the Data According to Measurements of Variations in the Global Intensity of the Hard Components of Cosmic Rays With the ASK-1 and S-2 Instruments."

A. I. Koval'skaya, "Problem on the Seasonal Variability of the Barometric Coefficient of the Hard Components of Cosmic Rays."

A. I. Koval'skaya, D. D. Krasil'nikov, S. I. Nikol'skiy, "Preliminary Results of Determining Barometric and Temperature Effects of Extensive Atmospheric Showers Near Sea Level."

Part III. The Nature of Variations in the Intensity of Cosmic Rays

Ye. S. Glokova, N. S. Kaminer, N. A. Mishina, "Cyclic and Seasonal Variations of the Diurnal Wave in the Intensity of Cosmic Rays."

A. I. Kuz'min, G. V. Skripin, "Relationship of the Diurnal Effect of the Intensity of Cosmic Rays to Geomagnetic and Solar Activity."

L. A. Fuks, B. F. Shchvartsman, "Temperature Effect in Seasonal and Diurnal Variations of Hard Components of Cosmic Rays According to Data of Cape Shmidt Station."

V. D. Sokolov, "Problem on the Nature of 27-Day Variations in the Intensity of Cosmic Rays."

L. I. Dorman, G. I. Freydman, "Intensity Burst of Cosmic Rays on 23 February 1956 and Its Interpretation."

A list of the symbols used in the articles is also included. (Trudy Yakutskogo Filiala, Seriya Fizicheskaya, No 2, 1958, 170 pp, Variatsii Intensivnosti Kosmicheskikh Luchey)

Original-Design Radio Telescope at Pulkovo

Scientists often receive signals from Jupiter evidencing intensive electrical discharges in its atmosphere. This possibility was opened by radio astronomy.

These sensitive radio telescopes received radio waves emitted by the atoms of interstellar hydrogen and made it possible to estimate its density in different part of the universe.

Scientists create powerful antennae for detecting weak radio emission from the cosmos, radio telescopes which look like enormous cups, up to 76 meters in diameter. Mirrors with a diameter of up to 180 meters are planned.

A radio telescope of original design has been built at the Pulkovo observatory under the supervision of Prof S. E. Khaykin. It resembles a large band cut from a gigantic cup. The band is made up of separate flat plates fastened to movable supports. Shifting of the plates makes it possible, in fact, to change the orientation of the whole band directing it to different parts of the heavens. The simplicity and reliability of such a design makes it possible to build extremely larger radio telescopes which are able to peek into now unattainable distances of space of the universe. ("Outshoots of a New Science," by I. Radunskaya, engineer; Moscow, Izvestiya, 18 Mar 59, p 6)

III. METEOROLOGY

Cloud Seeding Introduced into Soviet Civil Aviation Operations

The use of cloud scattering methods developed by the Central Aerological Observatory (TsAO) in civil aviation operations is reported by I. Gayvoronskiy, Candidate of Geographical Sciences. This is done with the aim of preventing interruptions of scheduled flights on the USSR's domestic airlines.

The method used for "opening" an air field covered by clouds or fog is to make several upwind passes with a plane scattering carbon dioxide. Each pass clears a band of from 3-5 kilometers wide in a matter of about 5 minutes. Specially equipped planes are used for this purpose.

The scattering of supercooled fogs over airdromes is also possible, using matter which has a structure similar to that of ice, such as silver and lead iodides.

These artificial methods of causing precipitations can also be used in the destruction of cumulus clouds, thereby removing another hazard encountered by airplanes along their routes.

Improved methods of weather control will be forthcoming under the Seven-Year Plan. ("Nonflying Weather Will not Exist," by I. Gayvoronskiy, Candidate of Geographical Sciences, Moscow, Sovetskaya Aviatsiya, 14 Mar 59, p 3)

Lithuania To Conduct Studies on Radioactivity of the Atmosphere

Studies on radioactivity in the atmosphere at the Institute of Geology and Geography, Academy of Sciences Lithuanian SSR, have acquired a well-defined direction. Under the present Seven-Year Plan, it is proposed to expand considerably these studies and incorporate them into a separate problem, the physics of clouds, precipitations, and radioactivity of the atmosphere. This geophysical problem has both theoretical and practical value, since it is contiguous with physics of the atmosphere and with studies on radioactivity and cosmic rays, with radiology and geochemistry, and embraces a wide circle of problems existing in the juncture between existing sciences. ("Wide Front of Scientific Works," by Yu. Yu. Matulis, president of the Academy of Sciences Lithuanian SSR, Corresponding Member of the Academy of Sciences USSR; Moscow, Priroda, No 1, Jan 59, pp 36-38)

IV. SEISMOLOGY

Studies on Dynamic Theory of Elasticity for Thin-Layered Media

An account of studies of nonstationary interference waves which occur in elastic media consisting of thin, plane-parallel layers is given in an article in the source. The purpose of the article is to give a short review of the direction of the investigations and the results pertaining to the low frequency oscillations of systems containing thin layers. The problems touched on are closely connected to the engineering theory of vibrations of thin plates and to the problems of dynamic modeling on "plane models." ("Certain Problems on the Dynamic Theory of Elasticity in the Case of Media Containing Thin Layers," by G. I. Petrashen' and L. A. Molotkov; Leningrad, Vestnik Leningradskogo Universiteta, No 22, Seriya Fiziki i Khimii, No 4, 1958, pp 136-156)

Works on the Propagation of Elastic Waves

A review of recent theoretical results with respect to the dynamic theory of seismic wave propagation is given by G. I. Petrashen'. These results have considerably enriched and expanded the physical content of the theory of seismology and make it possible to develop a new method of approaching problems of experimental and applied seismology. A survey of the applications of these results to practical problems is also made. ("Works on the Propagation of Elastic Waves," by G. I. Petrashen'; Leningrad, Vestnik Leningradskogo Universiteta, No 22, Seriya Fiziki i Khimii, No 4, 1958, pp 119-136)

Report on the Tsunami of 4-5 November 1952 in the Kamchatka-Kuril Region

A report on the Tsunami of 4-5 November 1952, which struck the shores of Kamchatka and the northern Kurile Islands, by Ye. F. Savarenskiy, A. D. Dobrovol'skiy, V. I. Blodavets, L. N. Sretenskiy, A. Ye. Svyatlovskiy A. V. Zhivago, V. G. Tishchenko and G. A. Skuridin, made on commission by the Presidium of the Academy of Sciences USSR, has been published. The Tsunami, caused by a submarine earthquake, was accompanied by great destruction and many deaths. The report contains an analysis of the reasons and consequences of Tsunami and certain conclusions on the possibility of warning inhabitants of regions threatened by the Tsunami of future earthquakes.

In the compilation of the report the following information was used by the committee.

1. Data of the Seismic Service of the USSR on the Kamchatka earthquake of 4-5 November 1952.

2. The previous account of the Kamchatka earthquake by the Sakhalinsk Affiliate, Academy of Sciences USSR (I. I. Katushenok, B. K. Klimov, F. I. Monakhov and M. D. Ferchev);

3. The results of the inspection of many points of the Kuril-Kamchatka shores, conducted by A. Ye. Svyatlovskiy, B. I. Piyp, associates of the Laboratory of Volcanology Academy of Sciences USSR; by A. S. Ryshkova, geologist, of the Lenmorproyekt; and by V. G. Tishchenko, an associate of the Geophysical Institute, Academy of Sciences USSR.

4. Data of the Hydrometeorological Service USSR on the heights of the Tsunami waves at certain points of the Kuril-Kamchatka shore.

The introduction and first chapter are the work of Prof Ye. F. Savarenskiy and V. G. Tishchenko (Geophysics Institute, Academy of Sciences USSR). Chapter two was written by A. Ye. Svyatlovskiy, Candidate of Geological-Mineralogical Sciences (Laboratory of Volcanology, Academy of Sciences USSR). Chapter three was prepared by Prof A. D. Dobrovol'skiy (Institute of Oceanology, Academy of Sciences USSR) and A. V. Zhivago, Candidate of Geographical Sciences (Institute of Geography, Academy of Sciences USSR). A map of the epicenters was prepared by N. A. Linden, Candidate of Physicomathematical Sciences (Geophysics Institute, Academy of Sciences USSR). Photographs were made by A. Ye. Svyatlovskiy. The work was supervised by Prof Ye. F. Savarenskiy.

The contents of the report follow.

Chapter I, "Earthquakes and Tsunamis in Far Eastern USSR."

Chapter II, "Aftereffects of the 4-5 November 1952 Tsunami in Kamchatka and the Kuril Islands.

Chapter III, The Formation of Tsunamis Near the Eastern Shores of Kamchatka and the Northern Part of the Kurile Islands.

(Byulleten' Soveta Po Seysmologii, No 4, Tsunami 4-5 Noyabrya 1952 G.; Moscow, 1958, 60 pp)

V. ARCTIC AND ANTARCTIC

New Soviet Station in Antarctica

The New Soviet Antarctic Station Lazarev was officially opened on 11 March 1959. It is located on Princess Astrid Coast (Queen Maud Land); its coordinates are 69 58 S and 12 55 E. The distance from the edge of the shelf ice is one kilometer.

Construction of the station began at the end of February. The expedition members worked in two shifts, unloading about 900 tons of equipment and erecting a number of buildings, including living quarters covering an area of 80 square meters, an electric power station, a radio station, a warehouse, an aerological pavilion, and meteorological and glaciological observation platforms. The expedition has two caterpillar tractors and one cross-country oversnow vehicle at its disposal.

Seven polar scientists will remain at the station Lazarev through the winter. Yu. Kruchinin, associate of the Arctic and Antarctic Scientific Research Institute, is head of the station. His coworkers are N. Makarov, meteorologist; N. Rukavishnikov, aerologist; A. Rozanov, physician; I. Ozerov, radioman; N. Komarov and Ya. Poluyanov, mechanics. Three of the station members, N. Makarov, I. Ozerov, and N. Komarov, have previously wintered in Antarctica.

During the forthcoming Antarctic winter, the station staff will conduct regular observations under the IGC program in the fields of meteorology, aerology, actinometry, glaciology, and geography. ("Named After Lazarev"; Moscow, Vodnyy Transport, 12 Mar 59)

Preliminary Results of Magnetic Research, Auroral Observations

A preliminary analysis of the materials of geophysical observations has produced some interesting results. For example, according to data on the condition of the magnetic field, received at the Mirnyy observatory from Soviet, as well as from several foreign stations, it is possible to determine the nature of the course of a magnetic disturbance. It appears that the laws, discovered by the Soviet scientist A. Nikol'skiy, governing the course of magnetic activity in the Arctic region may be applied, fundamentally, to the south polar zone. At the same time, some essential differences were discovered in the Antarctic. The frequent magnetic and ionospheric storms observed in 1958 were accompanied in many instances either by a disturbance or complete disruption of radio communications, by intensive auroras, and disturbances in the registration of earth currents.

The Soviet scientists registered several very heavy storms, which apparently embraced the whole globe. It is interesting to note that during the period of the most severe magnetic and ionospheric storms (7-10 July), when radio communications were completely disrupted, the radio operators at Mirnyy received signals from the third Soviet earth satellite. The audibility was one to three points on a five-point scale. This fact is extremely important for understanding the physical nature of phenomena in the ionosphere during a storm period.

Judging by data on the conditions of solar activity, the magnetic disturbances and the more intensive auroras were observed during periods of increased activity of processes on the Sun. This supports the scientists' opinion that magnetic disturbances, as well as a number of other irregular phenomena in the upper atmosphere, are caused by currents of electrically charged particles (corpuscles) coming from the Sun.

According to registration data obtained in Mirnyy concerning the three components of earth currents, scientific associate L. Pleshkevich drew the conclusion that a complete vector undergoes changes during a 24-hour period both as to size and direction, and that its spatial orientation reverses itself twice a day. This fact is of great scientific interest. According to visual observations of auroras conducted at Antarctic stations, one may assume that between the Pravda Coast and the south geomagnetic pole there is apparently a second zone of maximum activity of auroras, similar to that discovered in the Arctic region by A. Nikol'skiy.

In addition to stationary observations, some field work was done in terrestrial magnetism. In February 1958, Engr A. Agafonnikov, while working as a navigator of a continental sled-tractor train, made determinations of the magnetic declination in a number of points in the Antarctic interior. The observations conducted during field work indicate that the magnetic charts of East Antarctica are in need of essential corrections.

The results of geophysical observations obtained by the Soviet scientists are of great scientific and practical interest and will be an important contribution to the study of Nature. ("Great Practical Interest"; Moscow, Vodnyy Transport, 5 Mar 59)

New Vehicles for Fourth Expedition

The Khar'kov machine builders have produced three tractors of high maneuverability for use in Antarctica by the Fourth Soviet Antarctic Expedition. The length of each vehicle is 8 meters, and the width is 4 meters. These vehicles contain not only well equipped laboratories,

but also comfortable living quarters. A 2-meter high structure made of duralumin with special heat insulation is installed on the tractor. It contains the driver's cab, a recreation room, a bedroom for 8 persons, a navigator's compartment, a radio cabin, a kitchen with electric ranges, a compartment for drying clothes, a snow-melting compartment for obtaining water, and a washroom.

The total weight of the oversnow vehicle is 34 tons. The caterpillar tracks are one meter wide. The capacity of the motors is 120 horsepower over that of the former Antarctic tractor. The vehicle is adapted for operation at an elevation of 4.5 kilometers above sea level and under reduced atmospheric pressure. ("Gigantic Oversnow Vehicles-Tractors"; Kiev, Pravda Ukrainy, 25 Nov 58)

Huge Iceberg Encountered in Antarctic

The Slava whaling flotilla is continuing to navigate in the Antarctic seas. In approaching Ross Sea, the flotilla encountered thousands of icebergs. Recently, in the vicinity of Wilkes Land, the Slava met a gigantic iceberg, 107 kilometers long, 15 kilometers wide, and up to 40 meters high. An entire large city could be located on such an ice island. After 13 voyages, this was the first time the Slava flotilla met an iceberg of this size. ("In the Shadow of a Gigantic Iceberg"; Moscow, Vodnyy Transport, 3 Mar 59)

Books on Antarctica

A number of books on the Antarctic have been published in recent years. These include Mezhdunarodnyy Geofizicheskiy God v Antarktike (International Geophysical Year in the Antarctic), by A. F. Laktionov, published by Gidrometeoizdat (State Publishing House for Literature on Hydrometeorology) in 1957; and Mezhdunarodnyy Geofizicheskiy God (International Geophysical Year), by V. A. Troitskaya, published by Sovetskaya Rossiya publishing house in 1957; these describe the work being done in Antarctica.

Many research results have already been published. In 1958, an interesting book entitled Antarktika; Materialy po Istorii Issledovaniya i po Fizicheskoy Geografii (Antarctic; Materials on the History of Exploration and on Physical Geography) was published by Geografgiz (State Publishing House of Geographical Literature). ("Stories of the Conquest of Antarctica"; Moscow, Vokrug Sveta, No 2, Feb 59, p 59)

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